

Hva kan vi gjøre av tiltak for fisk i møte klimaendringer?

Hva betyr tørke og flom for fisken.

Frode Kroglund



Fylkesmannen i Agder



20.mar 2019

Fra fiskens ståsted er det her ikke tørt

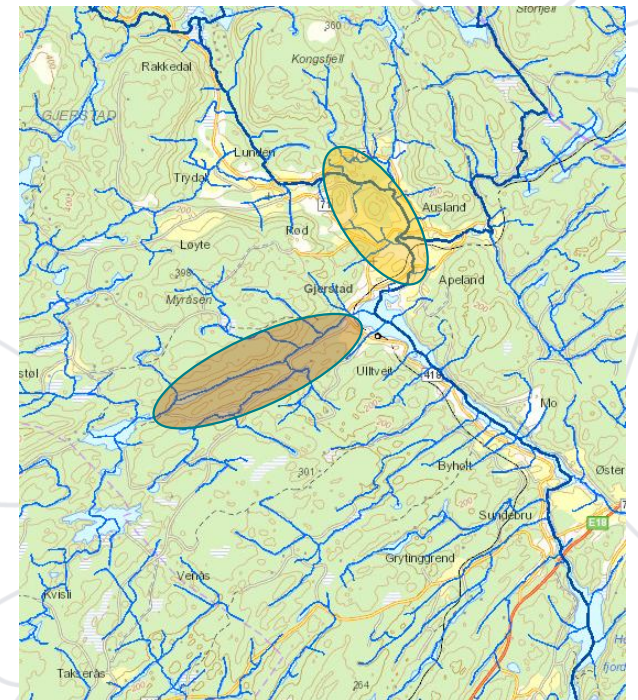
Hvordan kan fisken mene det?



Egdelva 14 aug 1983

F 83 8 14

Egdelva i Gjerstad
Egen ørretbestand
som er forskjellig
fra Storelvaørreten



Her er det vått, men gjør det noe?



Nidelva 3. sep 2017





Tørt og vått og fisk

Mer vann = flomm

Mindre vann = tørke

Innenfor rimelighetens grenser bryr ikke fisken seg

Hva mer/mindre vann til feil tid? Tidligere vår, seinere høst? Temperaturforandringer

Varmere vann på vinter og sommer; har det en effekt?

Kaldere vann i vårløsinga, som kommer tidligere enn før; hva betyr det? For smolten?

Tørt, fisken trekker ned i gruspakka og finner «grunnvann»

Vått, fisken trekker ned i gruspakka, men noen trekker inn over land. **Det er uklokt**

Hadde ikke fisken fiksa flom og tørke, hadde den ikke vært her nå

Flom i 2017 og tørke i 2018 er «naturlige» fenomener. Det betyr ikke at de hadde «null» betydning

I forrige slide nedtona jeg betydningen, men



Det er forskjell på enkeltår med negativ påvirkning og vedvarende negativ påvirkning

Vi må derfor gjøre det som er klokt nå, og ikke videreføre feilene fra forrige århundre

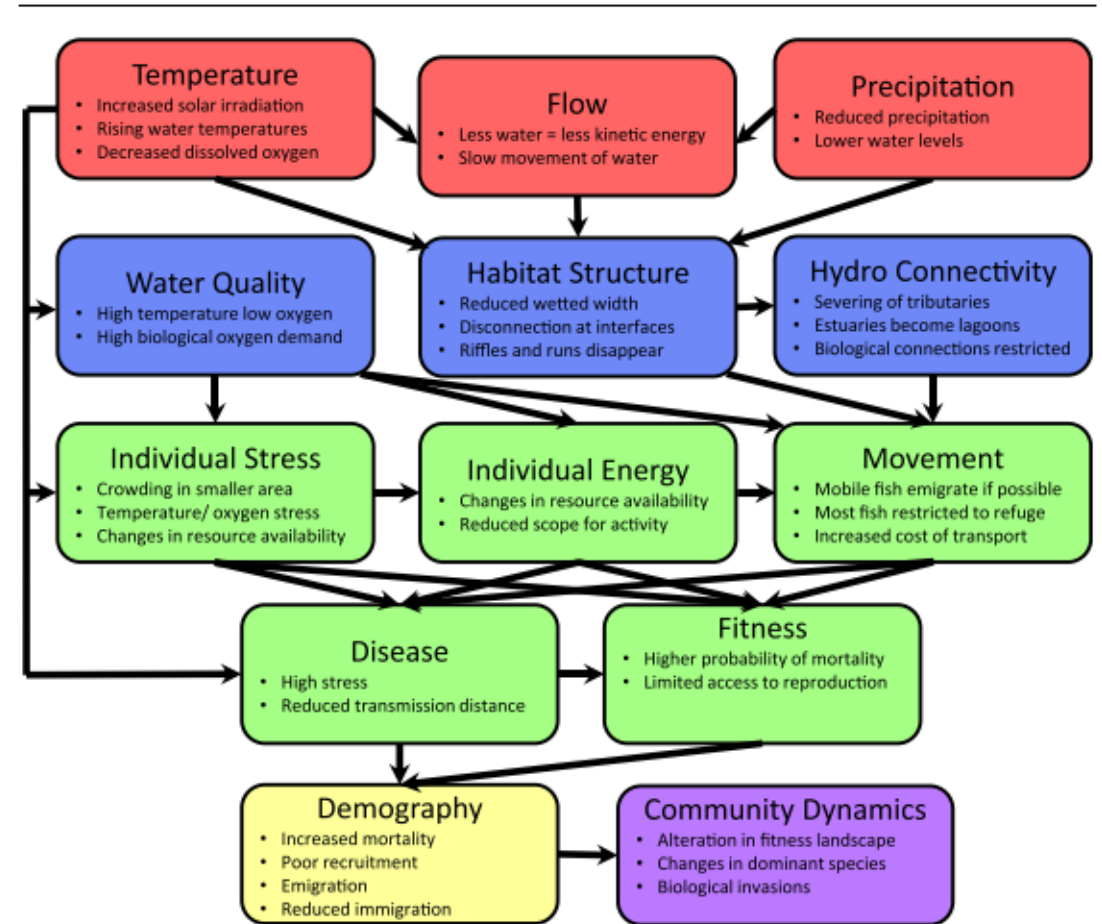
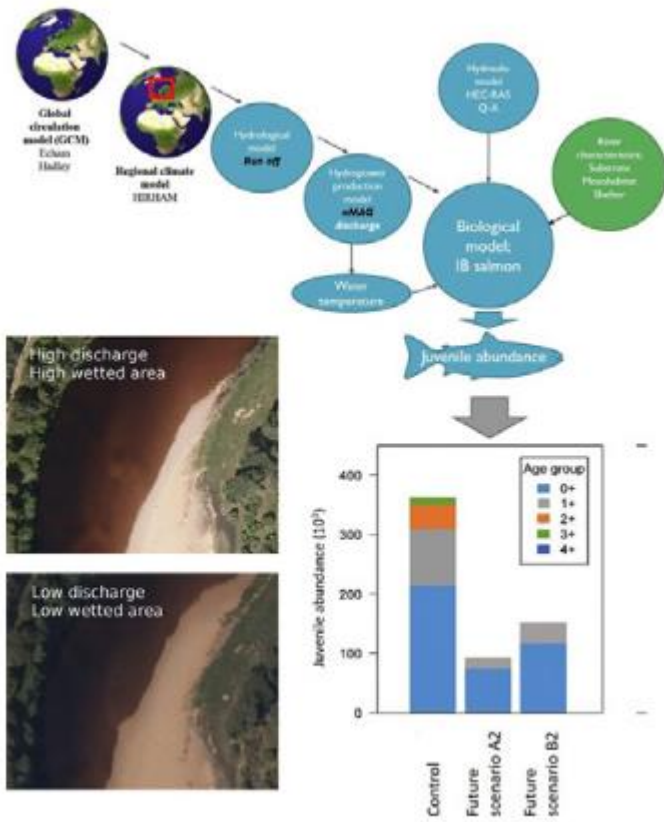


Fig. 1 Network of changes associated with drought in aquatic systems at the physicochemical (red), habitat (blue), individual animal (green), population (yellow) and community (purple) scales. Changes to temperature and precipitation contribute to low flows, which shift the energy dynamics within aquatic systems, alter habitat features and lateral and longitudinal connectivity, which can ultimately change the survival,

reproduction, and persistence of fish in aquatic systems. In this paper we review literature to develop an understanding of the role of key nodes in this network and important knowledge where a poor understanding of the abiotic and biotic processes underlying drought constrains the ability to manage fish and fisheries in drought

Otra og Mandalselva i et klimaperspektiv

Klima er et tema som er langt større enn Agder



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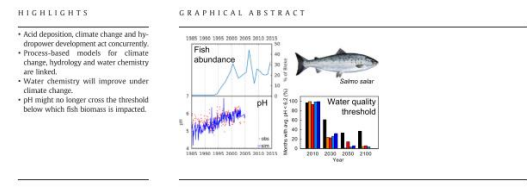
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Effects of multiple stresses hydropower, acid deposition and climate change on water chemistry and salmon populations in the River Otra, Norway

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ARTICLE INFO

ABSTRACT

Many surface waters in Europe suffer from the adverse effects of multiple stresses. The Otra River, south-western Norway, is impacted by acid deposition, hydropower development and increasingly by climate change. The river holds a unique population of land-locked salmon and anadromous salmon in the lower reaches. Both populations have been severely affected by acidification. The decrease in acid deposition since the 1980s has led to partial recovery of both populations. Climate change with higher temperatures and altered precipitation can potentially further impact fish populations. We used a linked set of process-oriented models to simulate future climate, discharge, and water chemistry of five sub-catchments in the Otra river basin. Projections to year 2100 indicate that future climate change will give a small but measurable improvement in water quality, but that additional reductions in acid deposition are needed to promote full restoration of the fish communities. These results can help guide management decisions to sustain key salmon habitats and carry out effective long-term mitigation strategies such as liming. The Otra River is typical of many rivers in Europe in that it fails to achieve the good ecological status target of the EU Water Framework Directive. The programme of measures needed in the river basin management plan necessarily must consider the multiple stresses of acid deposition, hydropower, and climate change. This is difficult, however, as the synergistic and antagonistic effects are complex and challenging to address with modelling tools currently available.

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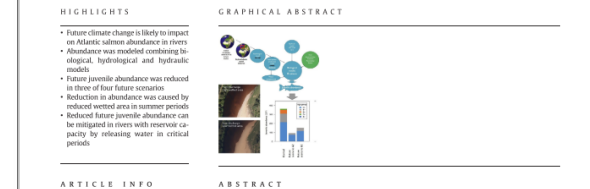
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Modelling climate change effects on Atlantic salmon: Implications for mitigation in regulated rivers

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ARTICLE INFO

ABSTRACT

Climate change is expected to alter future temperature and discharge regimes of rivers. These regimes have a strong influence on the life history of most aquatic river species, and are key variables controlling the growth and survival of Atlantic salmon. This study explores how the future abundance of Atlantic salmon may be influenced by climate-induced changes in water temperature and discharge in a regulated river, and investigates how negative impacts in the future can be mitigated by applying different regulated discharge regimes during critical periods for salmon survival. A spatially explicit individual-based model was used to predict juvenile Atlantic salmon population abundance in a regulated river under a range of future water temperature and discharge scenarios (derived from climate data predicted by the Hadley Centre's Global Climate Model (GCM) HadRM3) and the Max Planck Institute's GCM (ECHAM5), which were then compared with populations predicted under control scenarios representing past conditions. For abundance decreased in all future scenarios compared to the control scenario due to reduced wetted areas (with the effect depending on climate scenario, GCM, and GCM spatial domain). To examine the potential for mitigation of climate change-induced reductions in wetted area, simulations were run with specific minimum discharge regimes. An increase in abundance of both large and small occurred with an increase in the limit of minimum permitted discharge for three of the four GCM/GCM spatial domains examined. This study shows that, in regulated rivers with upstream storage capacity, negative effects of climate change on Atlantic salmon populations can potentially be mitigated by release of water from reservoirs during critical periods for juvenile salmon.

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Local and global climatic drivers of Atlantic salmon decline in southern Europe

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ARTICLE INFO

ABSTRACT

The abundance of Atlantic salmon is declining throughout its geographical area. Fisheries and global warming were assumed as main drivers of the decline, and recent studies suggest that habitat changes in freshwater is a third contributor. Southern populations experience the greatest decline, and face the highest risk of extinction as global warming moves its thermal niche northwards. We analyzed long-term catch data (1949–2013) from a salmon fishery in southern Spain, and examined its relationship with local and global indicators of temperature and hydrological change. CPUE data, analyzed by ARIMA time-series models, exhibited a significant negative trend and a marked decrease since 1973–1974, possibly triggered by overfishing at sea and a sudden outbreak of disease. Temperature increased in the same period, particularly so since 1966–1968, being negatively correlated with CPUE. A significant change in magnitude and duration of extreme water conditions occurred from 1970s onwards. Indicators of hydrological shift were also significantly correlated with CPUE of returning salmon. The best ARIMA models indicated however, that the decrease in salmon CPUE was mainly driven by temperature trends. This indicates that both local (temperature and flow in the river) and global (ocean temperature) factors have contributed to the decrease in salmon numbers, and that temperature has played the major role. Despite a strong reduction in fishing pressure after the 1970s widespread collapse, our study population did not recover to previous abundance levels. This suggests the operation of additional factors, being climate warming and changes in food webs of the North Atlantic the most likely reasons.

1. Introduction

Climate is important for nearly all aspects of life on earth. For instance, it influences species abundance, geographical distribution and behaviour as well as interspecific interactions in food webs (Vivek et al., 2010). Thus, with climate change, the ecology of species varies, and predictions on species responses to climate change strongly rely on projecting altered environmental conditions on species distributions and abundances.

One species that has exhibited a dramatic decrease in abundance during recent years is Atlantic salmon *Salmo salar* (Crispie, 2012; Kallio et al., 2013; Friedland et al., 2014). The total reported nominal catch has fallen by ca. 90% in 40 years from ca. 10,000 tons in the early 1970s to ca. 1000 tons in recent years (Crispie, 2013). The consistency in the global trend, in spite of variation in smolt production, suggests that factors influencing survival and growth at sea most likely are responsible for a large part of the decline in North America and Europe (Friedland et al., 2003; Jonsson and Jonsson, 2004). The decreased marine survival has been attributed to overexploitation, global warming and decreased zooplankton abundance in the North Atlantic (e.g. Peters et al., 2004; Todd et al., 2008; Bergmann and Bend, 2013), but in several cases, local conditions are blamed (Valland et al., 2009; Otter et al., 2011). The variable explanations may be because Atlantic salmon exploit freshwater, estuarine and oceanic habitats, and factors affecting their survival in all these environments influence population abundances. Possibly, the influence of factors in freshwater may be greater than previously assumed (Otter et al., 2011), and that fluctuating conditions in freshwater may be a key to the river viability of the species, particularly in southern populations in Europe and North America (Friedland et al., 2009; Jonsson and Jonsson, 2017).

Climate change is expected to have a negative effect on early life stages of salmon in freshwater (Jonsson and Jonsson, 2009; Todd et al.,

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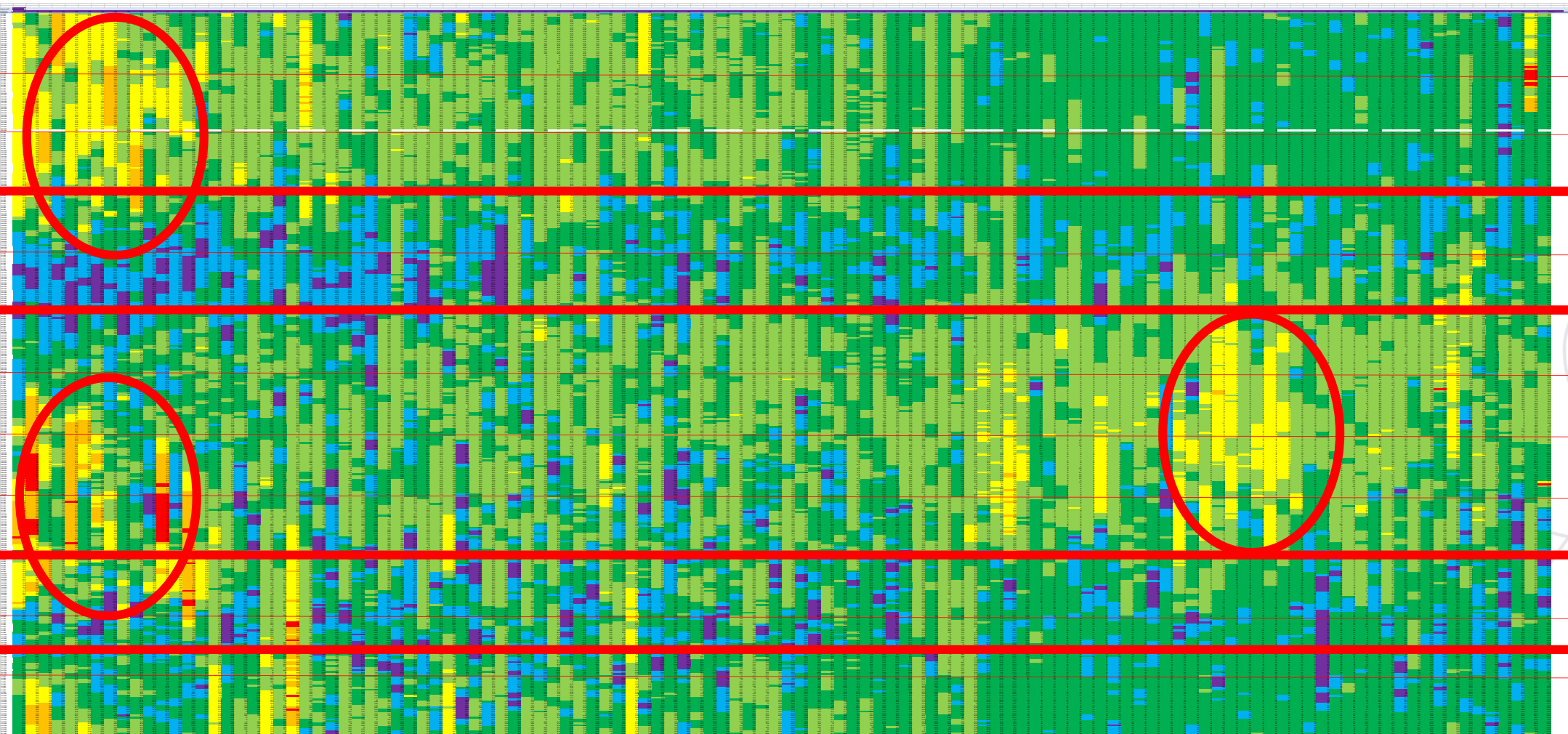
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Vannføring v/Rygene i 100-års perspektiv

Vinter- og sommertørke er borte

Vårflom er endret; mindre vann nå enn før

I Nidelva var variasjonen gjennom året større «før» enn nå. Fisken tålte variasjonen



	m3/s
9	0-10
9	10-20
19	20-40
39	40-80
79	80-170
169	170-340
339	>340
350	
350	



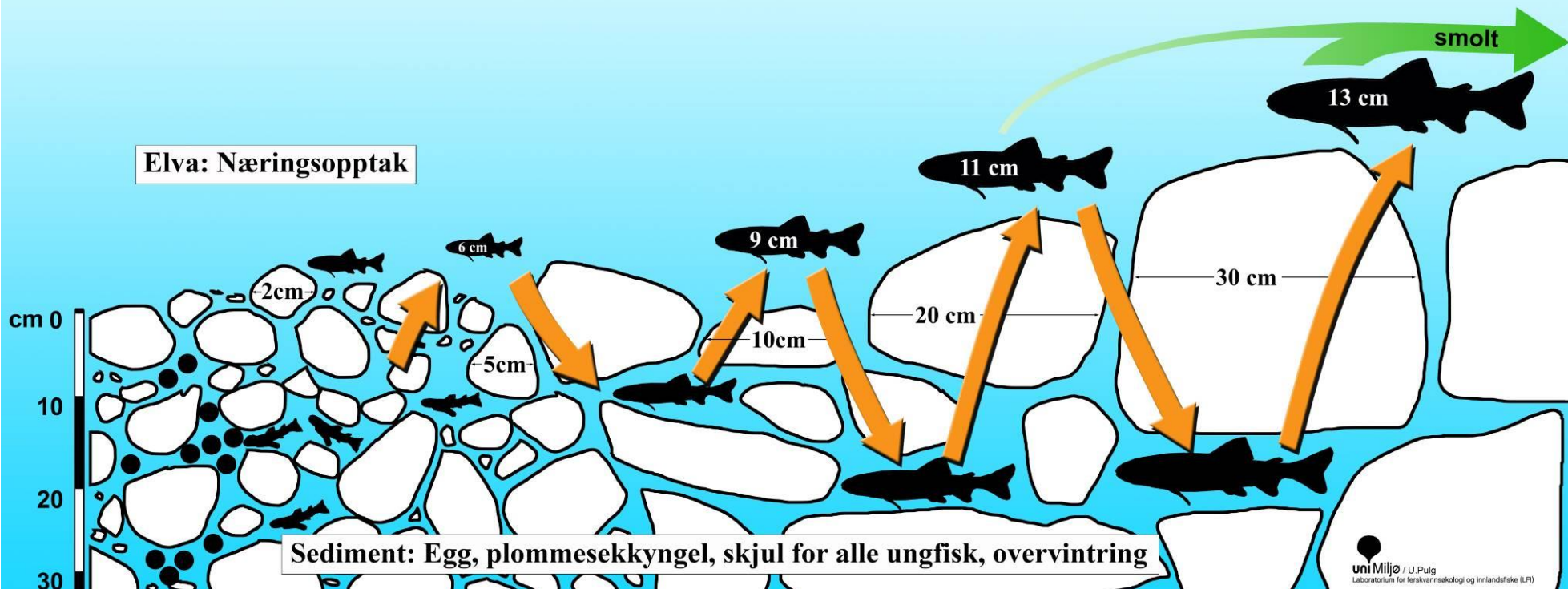
De neste slides er stjålet fra UniMiljø, UniResearch eller
NORSE;

uansett er de fra Barlaup og Pulg

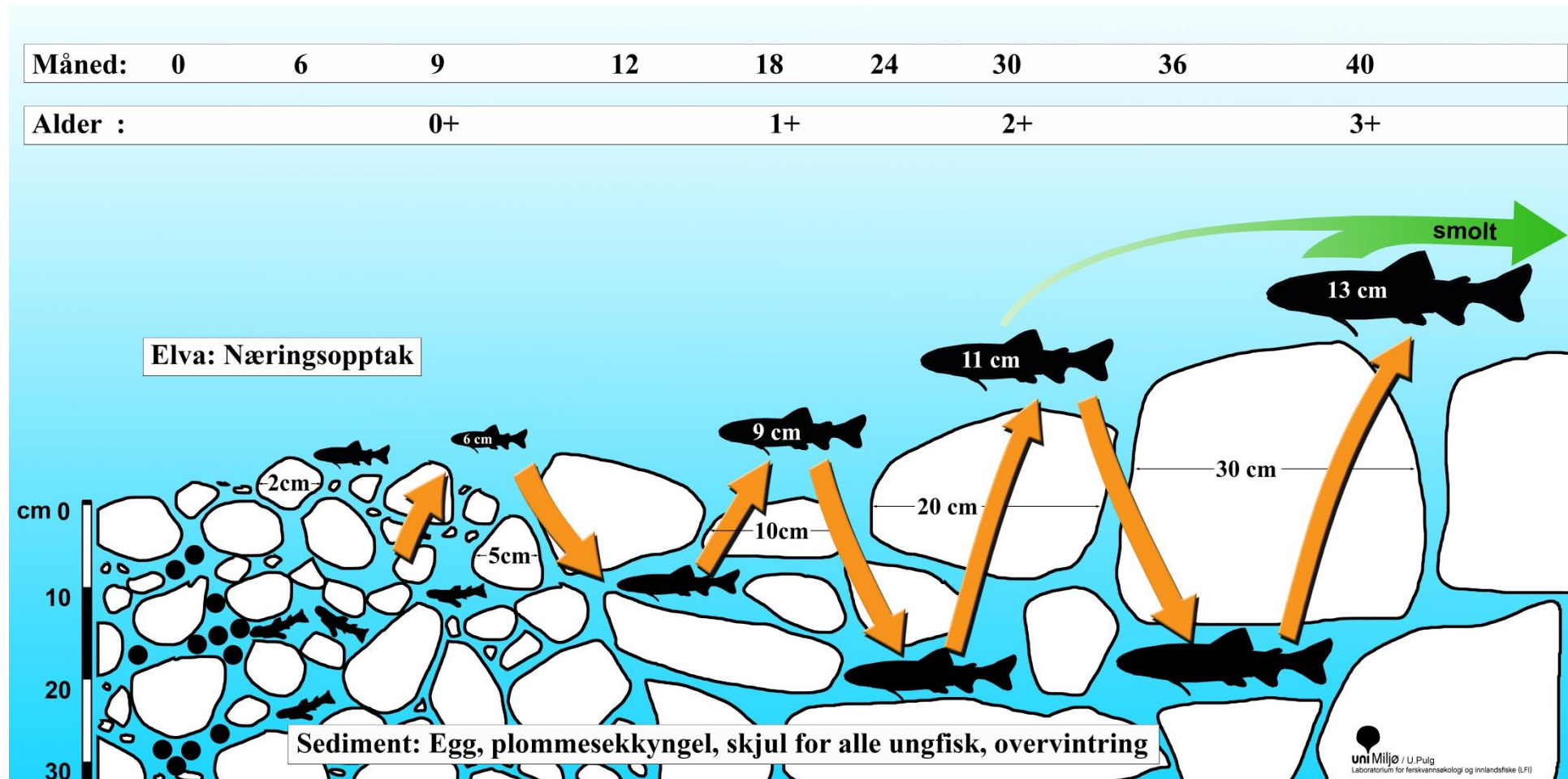


Hvorfor er substratet så viktig?

Måned:	0	6	9	12	18	24	30	36	40
Alder :		0+			1+		2+		3+

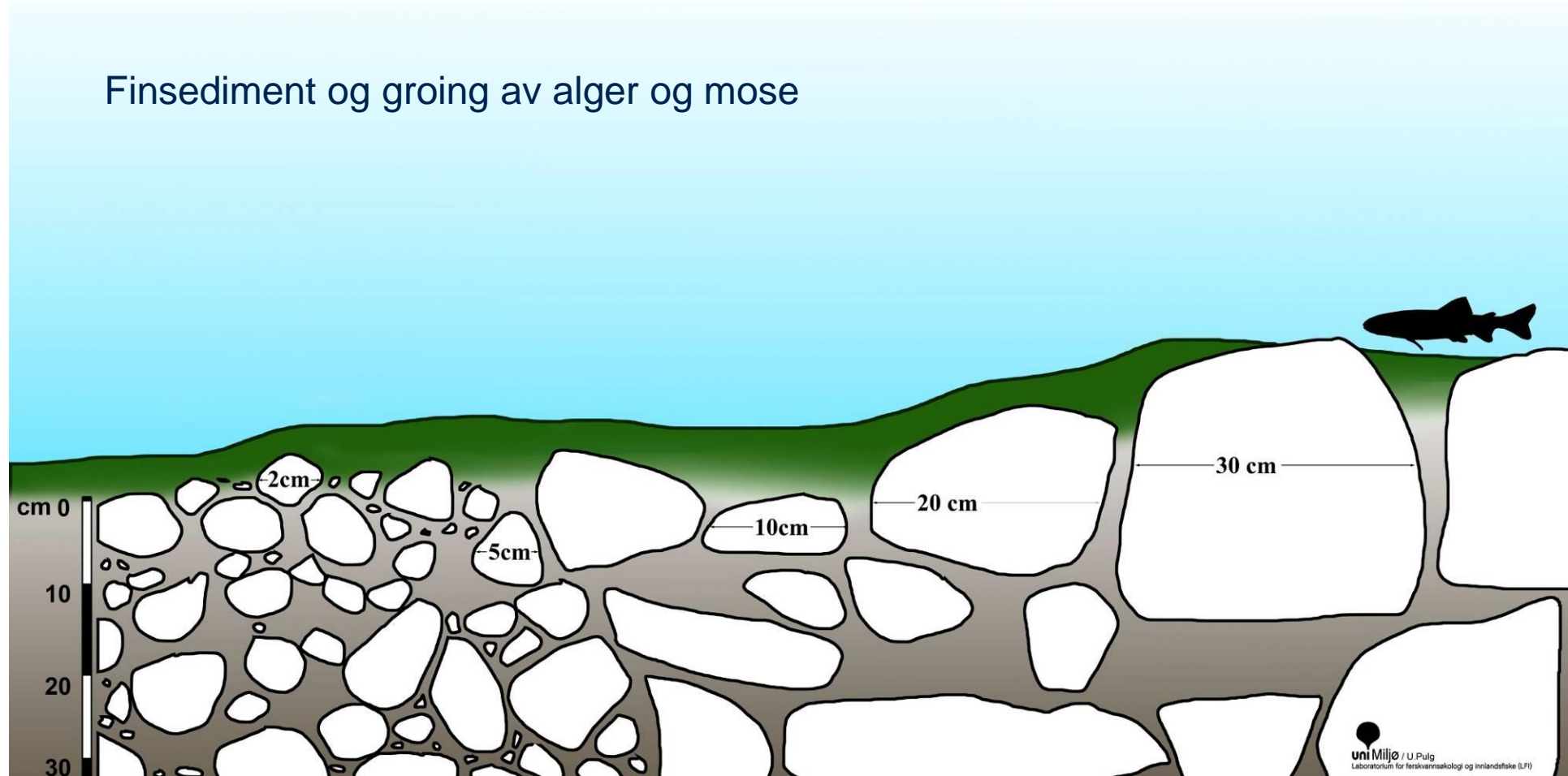


Fisk lever i vann – og i sediment.



Regulering forandrer sediment.

Finsediment og groing av alger og mose



Alt som øker erosjon bidrar negativt



Er flom og tørke kritisk?

- Nei, fisken er tilpasset, men, for mye av det gode er ikke bra
- Når vi **misligholder** substrat (nedsilting) kan ikke fisken trekke ned og den dør
 - Ikke klima som er feil, men vår mislighold av vassdragene
- Avbøtende tiltak: Store elver; utlegging av grus og stor stein = avbøtende tiltak for å skape oppvekstområder
 - Nidelva, Otra, Kvina, Lygna, Audna har, eller er vurdert for tiltak
 - Sidebekker:
 - Mandalselva sjørretklubb, sug og spy
 - Ajff; grav og grus
 - Ljff; grav og grus
 - Kjff; grav og grus

Jeg ønsker meg mer kunnskap om sug og spy

Klima og temperatur

Først frarøver vi fisken hulrom

Så koker vi den (høy temperatur = spisevegring, sykdom, død)

I tørkeperioder vil fisk trekke ned i gruspakka. «Grunnvann» er kaldere enn overflatevann

Hva gjør fisk hvis det ikke er mulig å gå ned i grusen eller ut av bekken/elv. Den dør

Har vi tiltak mens vi venter på klimaavtaler og effekter av disse?

Ja, sørg for gruspakka fungerer

Ja, spør hva gamle grinete gubber gjør når sola skinner. Fisken gjør det samme (de går inn i skyggen = kantvegetasjon)

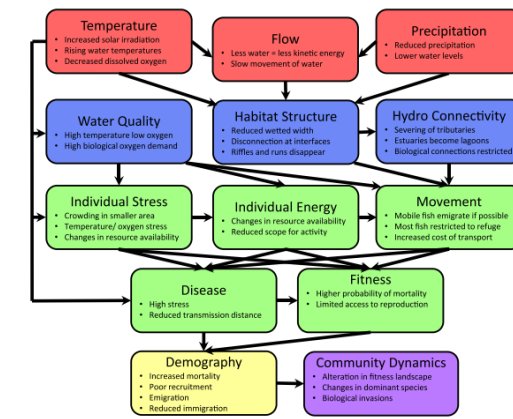


Fig. 1. Network of changes associated with drought in aquatic systems at the physicochemical (red), habitat (blue), individual animal (green), population (yellow) and community (purple) scales. Changes to temperature and precipitation contribute to low flows, which shift the energy dynamics within aquatic systems, alter habitat features and lateral and longitudinal connectivity, which can ultimately change the survival, reproduction, and persistence of fish in aquatic systems. In this paper we review literature to develop an understanding of the role of key nodes in this network and important knowledge where a poor understanding of the abiotic and biotic processes underlying drought constrains the ability to manage fish and fisheries in drought



Klimapåvirkninger forsterkes av våre handlinger

Fravær av kantvegetasjon ødelegger produksjon



Kantvegetasjon hemmer uønska erosjon = skjul opprettholdes

Fravær av kantvegetasjon = skjul gjenføres

Kraftverk hemmer steintransport = skjul gjenføres

Åpnet landskap (landbruk) ned til elv = økt erosjon + eutrofi

Skogsmaskiner og endring i vannårer i jorda = økt erosjon

Kanalisering av bekker = endring i erosjon

Steinforbygninger = tap av løsmasser

Inngrepene, hvis nødvendig, må gjøres ut fra kunnskap.
Hentes det inn kyndig hjelp?



Ygla - faktaark.naturbase.no/
foto Oddmund Wold



RENSEEFFEKT

% av overflateavrenning:

Partikler: 40-100 %

Fosfor: 40 - 95 %

Nitrogen: 25 - 90 %



Mitt ønske

At hulrom og kantvegetasjon blir tema i planarbeidet til kommune, fylkeskommune og fylkesmann

Og at dere går hjem og **ber om støtte til hull**

